



Canyon Country Outdoor Education

Third Grade Curriculum





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National Park Service
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FIELD TRIP

Force, Motion & Primitive Technologies

Theme

The prehistoric inhabitants of the Four Corners area used simple machines to help them make everyday tasks easier.

Utah State Science Core Curriculum Topics

Standard Three: Students will understand the relationship between the force applied to an object and resulting motion of the object.

Objective One: Demonstrate how forces cause changes in speed or direction of objects.

Objective Two: Demonstrate that the greater the force applied to an object, the greater the change in speed or direction of the object.

Standard Five: Students will understand that the motion of rubbing objects together may

produce heat.

Objective Three: Demonstrate that heat may be produced when objects are rubbed against one another.

Field Trip Location

Culvert Canyon or any outdoor area where the water table is close to the surface and there is a safe location for throwing Atlatls.

Times

All lessons are 30 minutes

Science Language Students Should Use:

distance, force, gravity, weight, motion, speed, direction, simple machine, temperature, degrees, lubricated, heat source, friction.

Background

Forces are pushes and pulls that can cause an object to change position, motion, or direction. The size and weight of an object can have a direct effect on the amount and type of force needed to cause these changes. Some forces are natural (i.e. gravity and wind). Other forces are manipulated by man (i.e. throwing an object towards another object or driving a car). Friction is created when objects resist an applied force. Often, friction results in heat. The purpose for all machines is to conserve energy. They decrease the amount of force that needs to be applied to create an intended motion.

There are several basic types of simple machines. The incline plane reduces the effort needed to raise an object by increasing the

distance it moves. One common form of an incline plane is a wedge, which uses inclined planes to separate things. A lever is a bar that tilts on a pivot. Applying force to one end of the lever produces a useful action at the other end. In a first-class lever, the fulcrum is between the load and the effort. In a second-class lever, the fulcrum is at one end of the bar, the effort at the other, and the load is in the middle. In a third-class lever, the fulcrum is at one end of the bar, the effort is in the middle, and the load is at the end. The center of the wheel and axle acts as a rotating lever. The wheel is the outer part of the lever. Friction is a force that appears whenever two surfaces rub against one another. It turns work into heat and sound, instead of useful motion.

Humans have always had to work for a living. During pre-historic times, people used natural materials to create tools that helped them do their work. Wood, stone, bone, and animals provided the raw materials from which they made everything they needed. A considerable portion of modern technology is a result of inventions made hundreds of years ago. The tools that pre-historic people made were both simple and compound machines.

The atlatl is a spear-throwing machine. It is a long stick that you hold in your hand. At one end of the atlatl, there is a notch in which you place the end of a dart. To use the atlatl, you throw with a casting motion (as if you are fishing). A dart thrown with an atlatl has more impact force than a simple bow and arrow and has been known to penetrate car doors and armor. The darts travel at a much higher velocity than if thrown by hand. They can also travel further than a spear thrown by hand. The atlatl is an example of a third class lever. The dart point is an example of a wedge.

Fire is a priority for survival. It is used for warmth, to cook food, to make tools, and much more. It is possible to start a fire using the friction produced by rubbing two sticks together. Rubbing two sticks together creates charred powder. When the powder piles up and gets hot enough, it will ignite. The small pile of dust or coal can be put into tinder and blown into flame. There are many different methods

to start fires by friction. These methods employ simple tools, such as the wheel and axle, levers, and wedges.

One of the primary tools of the hunters and gatherers was the digging stick. It was also an important tool for the agricultural tribes. Archaic people used the digging stick to dig edible tubers out of the ground and to dig for fresh water. Later, digging sticks were used to plant seeds. The wedge-shaped bottom was often fire hardened to add strength to the stick, making it easier to separate the soil. Once the digging stick was in the ground, it acted as a lever to lift the load it needed to get out of the ground.

Stone tools were also important to prehistoric peoples. Stone tools acted as both levers and wedges. Scraping motions were like a second-class lever. When sawing and cutting, Ancient Puebloans used stone tools as a wedge. Although we often think of multi-strike creations, such as arrowheads and spear points, when we think of stone tools, more often than not, tools were simple one-strike scrapers and knives. Simple stone tools can be made with river rocks. By hitting the corner of a lens shaped rock on a harder rock, you can make a simple or discoidal blade.

Clovis point



What machine is it??

Objectives

Students will be able to:

- Name two simple machines.
- Describe two primitive tools.

Materials

4 primitive tools (i.e. a digging stick, an atlatl, a bow drill, discoidal blades, or a mono and metate); paper; *simple machine* poster.

PROCEDURE

1) Ask students if they can define *force*. Tell them that forces are pushes or pulls that change the movement, direction, or position of objects. Ask students to think of some natural forces (i.e. gravity, wind, and explosions). Ask students if they can think of some ways that humans use or create forces (i.e. moving, throwing, and driving). Tell students that humans have created machines that help them use less force to accomplish tasks. Have students name some reasons they might want to use less force. Show the students the *Simple Machine* poster. Point to and describe each type of machine (lever, wedge, wheel and axle).

2) Tell the students that long before the pioneers came to this area, people called the Ancestral Puebloans lived here. Explain that they are also called the Anasazi and that they moved away about 700 years ago. Tell the students that the Ancestral Puebloans built the ruins (towers and stone buildings) that we sometimes find in southeastern Utah. Explain that they were a lot like you and me. For example, they found and ate food, built houses, farmed or gardened, played, and had families. Explain that because the Ancestral Puebloans had to work to survive, they invented machines or tools to help them.

3) Divide the students into four groups. Hand out a piece of paper to each group. Have the students divide the paper into four sections, by drawing two lines. Tell the students that you will give each group a tool to look at and describe. Explain that they are to look at, touch, and explore each tool before drawing it in one of the boxes on their paper. Have students work

together to predict how it was used, to describe how it would reduce force, and to guess what type of machine it is. Give hints as needed. Students should take turns recording the predictions for each of the tools.

4) Give each group 3-5 minutes with each tool before switching. When each group has looked at all four tools, go over them as a class. Ask students to demonstrate how they thought each tool was used and how it reduced the application of force. Describe what each tool is and what type of machine it is. Tell the students that we will be using all these tools on our field trip.

5) Preview the upcoming field trip, including agenda and behavioral expectations, and emphasize the importance of safety (as some of the tools we are working with can be dangerous). Review the items that students need to bring to school on the day of their field trip.

EXTENSION

Have students pick four objects from their classroom. Have students describe what type of machine each object is and draw the object labeling the machine's parts.

STATION #1

Atlatls

SAFETY IS VERY IMPORTANT AT THIS STATION!

Objective

Students will be able to:

- Describe why an atlatl is preferable to a spear
- Safely use an atlatl.

Materials

atlatls; darts; cardboard targets.

PROCEDURE

1) Discuss with students what primitive people ate. Tell them that although a lot of the food they ate was gathered or farmed, they also hunted. Ask students about difficulties involved in hunting animals (i.e. animals have good hearing, some of them can be dangerous, it's difficult to get close before the animal runs away, etc...). Ask the students how people overcame these problems. Ask students what weapons they think the Ancestral Puebloans used. Discuss the differences between spears, bows and arrows, and atlatls. Discuss why the atlatl is superior to a spear.

2) Ask each student to pick up three small rocks. Spread them out in a line, and have them pretend that their hands are connected to their shoulders. First, have them throw a rock using just their wrist. Point out that the rocks did not go very far. Throw the second rock using the forearm and the third rock using the whole arm. Discuss how the rocks went further when they used more of their arms. Explain that this is related to the increased force that is applied when more of their arm is used.

3) Using their hands, Have each student throw a dart towards the target. Mark in the sand where

the darts land. Explain how the atlatl works as an extension of your arm. Ask students to predict where a dart might land if the atlatl is used. Show the students how the atlatl allows for greater distance and greater throwing power. Discuss how using this lever increases the force you apply to the dart. Ask students why this might be useful if you were a primitive hunter (i.e. you could throw the dart farther and harder). Demonstrate how to load, safely shoot, and retrieve the dart.

4) Ask students if they can define *common sense*. Explain that *common sense* is what we all know if we just stop to think about it. Ask the students to give some common sense rules about throwing atlatls (i.e. they will wait for you to tell them it is O.K. to load and throw the dart and they will not be able to get their dart until you say it is O.K.).

5) Have students stand in a straight line, one next to the other, at least arm's length apart. Students should throw one at a time down the row until the whole row is finished. Remind students that NO ONE is allowed to collect their darts until everyone has fired. Note how much farther they can throw using an atlatl.

6) Talk about the difficulty of hunting. Tell students that if they lived a long time ago, people their age would be practicing how to hunt and playing hunting games to improve their skills. Hunting was a big responsibility and privilege. Discuss how ancient people used all parts of their prey including bones, tendons, organs, and skin. Remind students that today you need to have a license to hunt and must abide by specific rules.

Throwing atlatl



STATION #2

Fire

Objective

Students will be able to:

- Define friction.
- Explain how to make fire using two pieces of wood.

Materials

Fire Race (London, 1993); bow-drill set; tinder nests; hand drill set; water; fire pan.

PROCEDURE

- 1) Read *Fire Race*. Discuss with students why fire was so important to ancient people.
- 2) Have the students rub their hands together as hard and fast as they can. Ask students if they can feel their hands getting warm. Tell the students that they are using energy to rub their hands together. Explain that most of that energy is converted into motion, but that friction turns some of it into heat. Define *friction* as the resistance to force created by objects rubbing together. Tell students that if there is enough fuel, heat, and oxygen, fire is created. Ask students if they have ever caught something on fire using a magnifying glass. Explain that a magnifying glass focuses heat on a fuel to create fire. Tell the students that because ancient people did not have a magnifying glass to create heat, they used friction.
- 3) Show the students the bow drill set, and explain how each piece works. Pass the tools around for the students to feel. Explain how the bow drill works; tell the students that friction creates hot wood dust that will ignite and become a coal. To make a fire, the coal must be placed in a tinder nest. Use the analogy of a baby eating. When a baby is first born, it can only drink milk, just as a fire coal can only exist in the fireboard. If you give the baby carrots, it will choke, just like the fire will choke if it is given large logs. When the baby gets a little bigger, it can eat baby food, just as the fire coal can consume the tinder nest. If you go straight to carrots the baby/fire will choke. Only when the baby is older, when the fire gets much bigger, can you finally put it into the sticks. Have each student crush up some juniper bark and put it on the tinder nest.
- 4) Try to demonstrate how a fire is made. While you are working, ask students if they should ever try this at home and explain why not. If you are lucky, you will get a fire going in the tinder nest. If so, take the tinder nest to the fire pan. Discuss the fire pan and how it reduces

both fire scar and the risk of the fire escaping. Discuss how important it is to completely put out fires. Put dirt on the tinder nest. Show students how to feel a fire with the back of their hand to see if there is any heat remaining.

5) Tell students that it is their turn to try using a fire-starting machine. Explain the hand drill method of making fire; each person rubs a stick between their hands, pushing down as they twist the stick. Remind students that it is friction that creates the heat that causes the fire, so the more pressure they give and the faster they go, the more likely they are to get fire. Have each student take turns using the hand drill. Switch quickly and often so everyone can work hard and fast. Good luck!

6) If there is time, have each student take turns working the fire bow with you.

STATION #3

Digging sticks

Objective

Students will be able to:

- Explain how a digging stick reduces the amount of force needed to move soil.
- Use a digging stick to collect food.
- Name a similar modern day tool.

Materials

4 digging sticks; 18 clay taters; picture of a Sego Lily.

PROCEDURE

1) As you collect students from their previous station, inform them that they are going to pretend they are a primitive family on a hunting trip. Tell them that they are going to have to collect enough food to feed the village. Tell them that you are leading them to a spot where animals often gather. As you arrive at the pond, ask students why this place might attract animals. Since there are no animals, ask the students how they are going to collect enough food to feed their village. Describe the Sego Lily and other various root crops that could be collected year round.

2) Show students the digging sticks. Discuss how the shape of the stick allows people to move more dirt than using just their hands. Ask students if they can think of a modern day tool that is similar (i.e. crow bar, shovel).

3) Ask the students what they think the Ancient Puebloans might have dug with the sticks. As an example, have the students dig a hole in an area of wet sand. Ask the students what they think this hole will produce. Tell them that you will come back later to find out.

4) Tell the students that for thousands of years archaic people used digging sticks to dig up tubers. Define *tubers* as big, fat plant roots that we eat (i.e. potatoes or yams). Tell the students that in our area, archaic people ate tubers such as the Sego Lily. Show students a picture of the Sego Lily, and explain that it is our state flower because the pioneers used it for food. Tell students that after the ancient people became farmers, digging sticks were used to plant seeds, as well as harvest.

5) Demonstrate how to use the digging stick to dig up a tuber. Explain that if you pull on the stem it will break off and the tuber will be lost under ground. Have students practice using their digging sticks by digging up clay taters. Show students where the taters are growing,

and point out the pipe cleaner stems of the clay tater plant. Remind the students that if they just pull on the stems, the roots, or what they eat, will stay in the ground. They will have to use their digging sticks. Have students take turns digging and reburying their taters. Have students count how many taters they each dug up. Discuss with students who would be the hungriest and who would have the fullest bellies.

6) Return to the hole you dug earlier. Point out the water in the hole. Discuss with students the importance of digging for water in our desert climate. Point out that this water is much cleaner than water found in the river because the sand filtered it.

EXTENSION

Have students use field guides to find other plants with useful roots. Discuss how each plant was collected, stored and used.

STATION #4

Stones

Objective

Students will be able to:

- Describe two jobs for which stone tools were needed.
- Describe what force is used to make stone tools.

Materials

mano; metate; dried corn; a collection of points; river rocks

PROCEDURE

1) Ask students why they think ancient folks used tools made of stone. What sorts of things do they think people did with stones? Show students the mano and metate. Ask students if they know why it was used. Explain that a lot of seeds that are edible cannot be eaten unless they are ground up or boiled. Rice and wheat are good examples. Grinding seeds allows you to eat them without having to stop and cook. Discuss some modern ground seeds that we eat (i.e. bread, tortillas, crackers etc...). Relate it to their lunch.

2) Show students how to use the mano and metate. Discuss how the mano and metate increase the force you apply and make the job of grinding easier. Give them each a chance to grind some corn. Have students feel the meal ground by previous classes. Discuss how long it would take to grind enough corn for a meal. Explain to the students how friction works and why it grinds corn. Tell students that as they are grinding corn, they are also grinding away the rock. Explain that this is why grinding stones are rounded with depressions. See if they notice the sand in the meal, and discuss how Anasazi dental problems stemmed from the sand in their food.

3) Show the students a collection of points. Pass them around for students to feel. Describe how the Anasazi made and used them. Tell the students that although we think of stone tools as being fancy points like the ones being passed around, most tools were much simpler. Each of these points took a lot of time and skill to make. Most tools were simpler one-strike blades (i.e. scrapers, knives, and axes). Describe how the Anasazi made these stone tools using the force of impacts. The force of a strike travels through the rock creating a weakness; if the weakness is big enough, the rock will break. An expert knapper will know exactly where and how hard to strike the rock to get the desired effect.

4) Act out the following story. Tell the students they are living long ago and that they are taking shelter in a cave from a rainstorm when lightning ignites a nearby tree. They also see a rabbit nearby. The rabbit stops, and they kill it with their atlatl. Now they need a tool to skin the rabbit and cut the meat. Demonstrate how to hit the stones together and cause a flake to fall off. Explain how each flake is a wedge. Describe how this wedge or knife requires less force to cut through a surface.

5) Have students put on gloves and goggles for safety. Then, let each student choose stones to make a tool. Stones must be hit in just the right place with just the right angle. Help students to flake off a piece of the rock. When the group has made several flakes, have them pretend to skin their rabbit and cut it into strips. Have the students find a stick to roast their meat on and pretend to roast the rabbit over the burning tree.

EXTENSION

Have each student pick one artifact out of the points you brought. Have each student write a story about how the point was made, used and discarded.

Draw a Machine

(adapted from O'Brien & White, 40)

Objective

Students will be able to:

- a. Recognize that tools help to overcome force.
- b. Name a primitive tool.

Materials

paper with four third grade style lines on the bottom half.

PROCEDURE

1) Tell the students that, in order to survive, ancient people had specific needs. Write on the board *Food, Shelter, Water, and Clothing*. Ask students what humans have developed to help them apply less force to accomplish tasks and fulfill their needs. Explain that ancient people used simple tools. Ask the students what tools they think people used to fulfill each need. Under each need, list the tools that the students mention. Add to the list the tools that the students did not name. As students name a tool, ask them to describe how it helped Ancient Puebloans use less force or overcome natural forces. Some examples are:

Food – atlatl & dart, fire drill, knives, scrapers, digging stick, mano & metate

Shelter – digging stick, axe

Clothing –awl, atlatl, knife, scraper

Water – digging stick, fire drill (explain they needed to fire clay pots to hold water)

2) Have each student think of his or her favorite tool they saw on the field trip. Tell them that they are going to draw and write about their favorite tool. Pass out paper to each student. Instruct the students that they are to complete four sentences about their tool. Remind them to use capital letters and periods. Write on the board:

1. My favorite tool is _____.
2. It is used for _____ (food, shelter, clothing, water).
3. It helps me to _____ (throw farther, create more friction, etc.).
4. It is cool because _____.

3) Once students have written their sentences, have the students draw and color a picture of their tool.

4) If there is time, have students share their drawings and sentences.

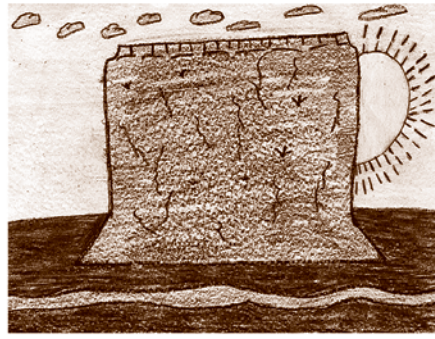
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RACHAEL NICCOL COPLIN

IN-CLASS PRESENTATION

Traveling Safely in the Desert

Theme

Knowing some safety procedures for hiking in the outdoors could save your life.

Objectives

Students will be able to:

- Name two items to take along for a safe hike.
- Name two safe responses if one becomes lost outdoors.
- List the four cardinal directions.

Materials

Lost in the Red Rocks (adapted from *Discovering Deserts*, 1985, 48-50); compass
direction signs

Time

30 minutes

PROCEDURE

1) Introduce the field trip by printing *Traveling Safely* on the board. Tell students you will be discussing ways of traveling safely when they are in the desert.

2) Ask students what the four cardinal directions are. Tell students that there are landmarks (big things you can see from far away) in each direction. Place the four directional signs around the perimeter of the classroom, and have students name landmarks in each direction. Tell students that once they know one direction, they can always find the others if they know the order. Have students turn and point to the directions while they say, "Never Eat Soggy Waffles." Have students stand by their seats for a quick round of Direction Freeze. Say a direction, and have students face that direction by the time you say, "Freeze!" Ask students to sit down if they are facing the incorrect direction. Increase the pace.

3) Tell students that directions help you find your way if you have a compass or if you know your landmarks. Tell students that a landmark is something really big you can see from far away or something really distinctive that everyone would notice. Give students examples of

landmarks that would help them to find their way to school. Give an example of landmarks you might see while out hiking (i.e. three canyons coming together, an arch shaped like a whale).

4) Ask students to listen closely to the story you are about to read and think about any mistakes as well as good decisions that the girl in the story makes. Read *Lost in the Red Rocks*. Have students list Claire's mistakes, and discuss each mistake (not paying attention to landmarks, where she was going, or to directions). Discuss what Claire could have done or taken with her to make her journey safer.

5) Remind students that Claire was not prepared to go on a hike. Ask students what they should bring with them if they go hiking. List these on the board.

6) Tell students that sometimes even if you are prepared you can get lost. Tell students that if they ever get lost, there are four things they need to do. Explain that all four things start with "S." Write "Seeking Shelter" on the board. Discuss what would be appropriate shelter in different weather. Write "Stay Put" on the board. Tell students that this is the most important thing to remember. If they remember

nothing else, remember to stay put. Tell the story of the little boy who died a few years ago because he did not stay put. Write “Stay Calm” on the board. Discuss how this is the hardest of all four things to do, because it would be scary to be lost and alone. Discuss things students could do to stay calm and pass the time (i.e. sing songs, make up stories, play games, think of their family). Write “Signal” on the board. Discuss how and when they should signal. Have the class say the four S’s with you. Ask them again, which is the most important thing to do, if they find themselves lost.

EXTENSION

Have students create a lost hiker story or dramatization. Tell them to include what the hiker did to be found, or to find her way, including the use of landmarks.

REFERENCES

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Lost in the Red Rocks

(adapted from *Discovering Deserts*, 1985, 48-50)

Clare was excited. For years, her parents had spoken of the red-rock canyons of southern Utah. During the last month, as they made plans for their trip, it seemed as if they talked of nothing else. Claire had never paid much attention to her parents when they talked of the red-rock country, but as they drove down the road leading to the Needles District of Canyonlands National Park, she couldn’t believe her eyes. She had never seen anything like these red and white sandstone cliffs and spires. Unfortunately, by the time they got to the campground, it was getting dark. Exploring had to wait until morning.

Now it was morning, and although her parents were still asleep, Claire was ready to go. Rather than wake her parents, she decided to go on a short expedition of her own. Deciding breakfast could wait, Claire started up a trail near the campground. The colors of the sunrise and the unfamiliar yuccas, cacti, and twisted juniper trees amazed her. As it warmed up, she wished she had worn her baseball cap.

A lizard scampering across the trail interrupted this thought. Claire left the trail in pursuit of a better look. She lost sight of the lizard, but followed its tracks in the fine sand. The tracks went into a slot in the sandstone! The slot was so tempting, just big enough for Claire to squeeze through. It led to a steep, slickrock slope to the top of a flat layer of sandstone. Claire climbed up.

After walking around on the sandstone ledge and taking in the view, she realized she was

getting hungry and very thirsty. Even though it was still morning, it was HOT out here.

She decided to find her way back to the campground. Soon, she realized that the ledge she was on dropped off in a vertical cliff on most sides. She started back in the direction she thought she had come from, but found higher cliffs instead. She began to panic and ran along the cliff edge. Before long she tripped on a rock and fell. Her ankle hurt, so she decided to stop and wait to be found. She moved into the shade of a nearby rock.

Before long she heard a human voice. Claire began shouting, and her mother answered back! Very relieved, she thought of breakfast, a cold drink or water, and hiking with her parents next time.

MISTAKES OR BAD DECISIONS

- Hiking by herself without telling anyone where she was going
- Not wearing a hat, taking water, food, a map, or a compass
- Not paying attention to directions and landmarks
- Panicking when she realized she was lost

GOOD DECISIONS

- Staying put - she hugged a rock and waited to be found
- Waiting in the shade once she hurt her ankle
- Yelling when she heard voices



FIELD TRIP

Living & Non-living Interactions

Theme

All things, living and non-living are constantly interacting with one another.

Utah State Science Core Curriculum Topic

Standard Two: Students will understand that organisms depend on living and nonliving things within their environment.

Objective One: Classify living and nonliving things in an environment.

Objective Two: Describe the interactions between living and nonliving things in a small environment.

Field Trip Location

Any area with some cryptobiotic soil, a variety of plants, and evidence of animals. A dry wash is usually diverse enough, and is an easy place to manage students without negatively impacting cryptobiotic soil or plants. Any season.

Times

Post trip lesson is 45 minutes. All the other lessons are 30 minutes.

Science Language Students Should Use:

environment, interaction, living, non-living, organism, survive, observe, terrarium, aquarium, temperature, moisture, small-scale

Background

An ecosystem can be defined as all the living and non-living things in a given area and their interactions. The non-living things include climate (weather, temperature, rainfall), geology (rocks, soil type), and geography (location of vegetation communities, exposure to elements, location of food and water sources relative to shelter sites). Soil is often comprised of both living and non-living elements. Living elements can continue to affect the community even after they change to non-living substances. An ecosystem is commonly a large area and can include many square miles of land or water. It includes many interconnected habitats. The two most important things to emphasize about an ecosystem are that all the members (living and non-living) are connected and that changes in one habitat or organism cause changes in another. Some relationships between members are direct and obvious. Other relationships are not so obvious.

A natural community is composed of plants and animals living and interacting within an area that has similar physical characteristics throughout. A community is usually defined by and commonly named for its predominant vegetation. Communities in southeastern Utah include canyon-riparian, slickrock, piñon-juniper, sagebrush, blackbrush, and montane.

Within a desert ecosystem, there are many communities, which all respond to these basic conditions: not much water (aridity), hot summer days, cold winter nights, and wind.

A food chain represents the transfer of energy from the sun to living organisms. Producers are green plants that use the sun's energy directly. Primary consumers (herbivores) feed directly on the producers. Secondary consumers (carnivores) feed on the primary consumers or other secondary consumers. Omnivores can be primary or secondary consumers.

Decomposers, such as bacteria, fungi, termites, and earthworms, are scavengers that feed on the organic material found in dead producers and consumers. They break down the organic material to the nutrient level. Nutrients in soils are essential for producers to grow. Nutrients include nitrogen, carbon, and phosphorous. Thus, dead consumers (and producers) are recycled back into new producers.

In every ecosystem, various food chains are interconnected in a food web. Food chains and food webs indicate the eating patterns of the members of an ecosystem. Each component of the food web is necessary for the health of the ecosystem as a whole.

Any food web or food chain is a system that transfers energy from the sun. Each link in the chain depends on the link below it. Producers incorporate the sun's energy and, in turn, are eaten by herbivores. Herbivores are eaten by carnivores or omnivores. Ninety percent of the energy is lost in each transfer, explaining why there are so many more producers than

herbivores and so many more herbivores than carnivores. A food pyramid, with producers at the bottom, primary consumers in the middle, and secondary consumers at the top, illustrates this concept.



PRE-TRIP ACTIVITY

All the Pieces

Objectives

Students will be able to:

- a. Describe the difference between living and non-living objects.
- b. Define *producer*, *consumer*, *herbivore* and *carnivore*.

Materials

Diorama, plastic tote painted to look like an empty landscape; pieces of the ecosystem; *The Most Unusual Lunch* (Bender, 1994)

PROCEDURE

1) Ask students if they can think of examples of *food chains*, and write a few examples on the board. Ask students to look at the first organism in every food chain. Point out that they are all plants. Explain that plants are also called *producers* because they produce their own food (using sunlight, water, etc.). Tell students that all the other organisms, which eat plants or other animals, are called *consumers*. Explain that the consumers can be divided up based on what they eat (*herbivores*, *carnivores* and *omnivores*). Add a *decomposer* or *scavenger* organism to the end of one or two of the food chains on the board, and describe them as eaters of dead stuff. Explain that they turn the food chain into a cycle, recycling nutrients back into the soil to help the producers grow.

2) Read the students the book *The Most Unusual Lunch*. Discuss the food chain that occurs in the story.

3) Ask the students if everything in an environment is alive. Have students name some things that are alive in the desert. Tell students that living things grow, change and reproduce. Some move about on their own. Ask the students if they can name some things that are not alive that might be important in an environment. Discuss how climate, geography, and soil affect the living organisms in an environment. Ask students if they know what organic matter is. Explain that it is stuff that is or was once alive. Ask them how dead organic matter might affect the ecosystem.

4) Tell the students that an ecosystem is an environment where all the living and non-living things interact with and are dependent on one another. Tell them they are going to get a chance to make an ecosystem. Bring out the empty diorama. Have the students pick a partner. Have each student pick an object from the diorama collection and discuss with his or her partner

what it is, how to classify it, and how it relates to the ecosystem. Some examples might include bighorn sheep are eaten by the mountain lion. The rock creates a home for the packrat. One at a time, have the students come and present their object to the class, tell how it interacts and place it in the diorama.

5) Discuss with the students what might happen if some or all of the objects in the diorama were changed.

6) Review what they will need to bring on their field trip.

STATION #1

Everything is Connected

(adapted from Van Matre and others, 1987)

What is it?

Objectives

The students will be able to:

- Describe a simple food chain.
- Name at least one producer, one herbivore, and one carnivore.
- Name one non-living thing and discuss how it affects its ecosystem.

Is it living or non-living?

If living, where does it fall in food chain?
(e.g. herbivore, carnivore).

Materials

yellow ball; string; photographs of producers, herbivores, omnivores, and carnivores (two or three of each); pencils; clipboards; paper.

4) Tell the students that non-living things can change an environment. As an example, ask the students to think of something that might affect everything in the desert ecosystem. Help them figure out that they are in a wash and that heavy rain sometimes fills up the wash and move things around.

PROCEDURE

1) Inform students that they are going to make a “munch line” or food chain. Place the yellow ball, which represents the sun, in a tree, or have a parent hold it. The string from the ball represents the sun’s energy that hits the earth. Pass out one postcard or photo to each student. Ask those who think that they are producers, who get energy directly from the sun, to stand up. Briefly discuss each of their photos, and have the group confirm that each organism is a producer. As each is confirmed, have them line up next to the sun, hold onto the string (energy) from the sun, and hold up their photos. Repeat the exercise with the herbivores, omnivores and carnivores, and discuss the differences. Have students make a c-shaped line for best group viewing.

5) Have the students pick one of the objects on their paper. Ask them to predict how their object would react to a flash flood. They should turn the paper over and record their predictions in either words or pictures. Remind them to think of the food chain they created earlier. Ask students to predict how the effects of the flood could be carried up the food chain. Have students present their object, questions, and predictions. Discuss how they could confirm their predictions.

2) Ask the students if they can think of something non-living that moves up the food chain, such as energy and nutrients. Discuss how energy is passed up the line and how some energy is lost at each level. Discuss how nutrients move through the food chain and are finally returned to the soil. Collect the postcards and photos. Have students think of some other non-living things that effect how plants and animals grow (e.g. location of water, soil vs. rock).

3) Divide students into pairs. Give each pair of students a clipboard, pencil, and paper. The paper should be divided into three sections with lines for writing in the bottom half of the sections. Ask the students to pick three things within set boundaries and to draw one in each of the sections. One thing should be smaller than a penny, one larger than a dog, and one in between (leaf, rock, tree, feather, or track). On the writing lines have the students answer the following questions about each object.

STATION #2

All Things Dead or Alive

Objectives

Students will be able to:

- Describe the nutrient cycle.
- List three decomposer organisms.

Materials

nutrient cycle poster; pictures of decomposers; box of nutrient-rich soil with different types of decomposers; hand lenses; leaf picture.

PROCEDURE

1) Have students name some characteristics of both living and non-living things. Tell the students that soil contains nutrients (minerals) that all living things need in order to grow. Some of these nutrients are nitrogen, carbon, calcium, and phosphorous. Ask the students if they have ever helped their parents fertilize a garden or house plants. Explain that when you are fertilizing plants, you are adding these nutrients. In nature, these nutrients are returned to the soil by decomposers. This is called the nutrient cycle. Discuss the nutrient cycle poster and the interaction of the nutrient cycle with an entire ecosystem.

2) Tell students that for the next game, they are going to imitate a variety of decomposers. Show and have students practice the various poses or movements. Play Cycle Says in the manner of Simon Says. The goal of this game is to reinforce the diversity of decomposers and to review their role in cycling nutrients. Some suggestions are:

- Caw like a raven.
- Crawl like a beetle.
- Arms up in a “V” like a turkey vulture.
- Be small like bacteria.

- Wiggle like an earthworm.
- Chew like a termite.
- Wave antennae like an ant.
- Stand up like a mushroom.
- Inch along like a larva.
- Spin silk like a spider.
- Move like a millipede.

3) Show pictures of decomposer organisms. Bring out the box of soil with decomposers in it. Use hand lenses to explore the different kinds of decomposers present in the soil. Point out that some of the non-living things in the box were once alive. Explain that it is this dead organic matter that the decomposers eat. In soil, it is recycled back to the nutrient level so that plants may use it. Observe the nutrient-rich soil, and compare it to a handful of sand from the wash. Ask the students which soil type has more nutrients in it? In which soil type will plants grow better?

4) Play the Circle Cycle Game in the manner of Duck, Duck, Goose. Have one student decide what decomposer, or nutrient “cyclor,” he wants to be. Have that student take the “nutrients” (the leaf) and walk around the outside of the circle. The cyclor drops the nutrients in front of a seated player and runs around the circle. The seated player picks up the leaf and tries to tag the cyclor. The cyclor tries to get back to the spot where that player was seated without getting tagged. If the cyclor is tagged, then she remains the cyclor and tries again. If the cyclor succeeds in sitting in the abandoned spot before getting tagged, the other player becomes the new cyclor.

Studying decomposers



STATION #3

Who's for Lunch?

Objectives

The students will be able to:

- Discuss the interplay of population and food supply in a predator-prey relationship.
- List at least two causes of changes in the balance of nature.

Materials

predator and/or prey puppet; copy of story "*Glusabi and the Game Animals*" (Caduto and Bruchac 1988, 164-169); blindfolds (for extension/variation activity).

PROCEDURE

1) Use a puppet (e.g. fox) to discuss the concept of predators and prey. Have the students' name some things that the fox might want to eat. Have the students tell you if the animals they name are herbivores, omnivores, or carnivores. Discuss that these animals are prey for the fox and the fox is the predator. Ask the students if an animal can be both predator and prey. Have the students name some animals that might eat the fox. Discuss that these animals are carnivores or omnivores. Introduce the idea of population fluctuations by having the puppet lament over what will happen to him and his friends if there aren't enough mice available. Discuss some living and non-living things that might cause living populations to fluctuate.

2) Read "*Glusabi and the Game Animals*." Discuss the story and its lessons. Ask why Grandmother Woodchuck told Glusabi to put the animals back where they belong. Ask

students what they think Grandmother meant by, "Things must be in the right balance."

Discuss the fluctuation of populations and what happens when there are too many or too few predators. Discuss how a balance in nature is critical to a healthy ecosystem.

3) Instruct students in how to play the Predator-Prey Race. Draw three parallel lines, about fifteen feet apart, across a sandy, open area. Have the group stand facing each other near the center line (close enough so that students can touch outstretched fingers). The other two lines indicate safe zones. Assign a predator name to one team and its prey to the other. Instruct students to think quickly, run to their safe zone if they are prey, or run after and try to tag the prey if they are predators. Any tagged prey must join the predator team, and a new round begins. Start off with obvious predator-prey pairs, and then proceed to trickier ones. Discuss any pairs that produce confusion, before the next round. Relate fluctuations in numbers of students on each team to the previous discussion of population fluctuations. Point out instances when the ecosystem is out of balance. Examples include: *dragonflies/mosquitoes, grasshoppers/plants, spiders/insects, foxes/mice, mountain lion/ mule deer, bald eagle/fish, bobcat/rabbit, desert bighorn sheep/indian ricegrass, rabbit/rabbitbrush, mosquitoes/humans.*

Note: Navajo students could have cultural difficulties if coyotes, bears, or reptiles are discussed in food chain situations. Try to avoid using these animals in the predator-prey game.

Discussing the concept of predators and prey with a fox puppet



The Mask of Life

Objectives

Students will be able to:

- Define the terms *producer*, *herbivore*, *carnivore*, and *omnivore*.
- Describe the proportions of a balanced ecosystem.

Materials

poster of animals; bucket; category cards (11 cards labeled producer, 6 herbivore, 3 omnivore, 1 carnivore, and 4 decomposer); blank masks; craft sticks; construction paper; glue; markers; scissors.

PROCEDURE

- 1) In the classroom, review the definitions of *ecosystem*, *producer*, *herbivore*, *carnivore*, *omnivore*, *decomposers*, *living things*, and *non-living things*.
- 2) Tell the students that they are going to become living things in an imaginary ecosystem. Discuss how everything interacts. Ask the students to name some creatures they might find in the desert ecosystem. Write answers on the board in the appropriate category (herbivore, carnivore, etc.) Ask the students to predict how many things out of each category they would expect to find in an ecosystem of twenty-five living things. Write the answers on the board. Tell the students that the ecosystem they are going to make is similar in proportion to a real ecosystem and that there will be similar numbers of creatures. Explain that they will each pick a card out of a bucket that has a category written on it. Once they get their card, they get to choose an animal in that category to become (they can either look at the list on the board or the animal poster for their choices). Show the students the animal poster. Walk around, letting each student pick a card from the bucket. As you collect the cards, make sure all the children have picked an animal. Tell the students that they get to become their animals by making masks.
- 3) Show them examples of masks made for some of the animal choices. Distribute blank masks, craft sticks, construction paper, markers, scissors, etc. Give students about 15 minutes to make their masks.
- 4) Tell the students that it is time to see how many different things are in our imaginary ecosystem. Ask the students who are producers to hold their mask and stand up at their desks. As a class, count how many there are, and

record the information on the board. Discuss how their predication differed from the actual number of producers in the ecosystem. Repeat with the other categories of animals. Ask the students how they could conduct a similar experiment in the natural world.

EXTENSION

Have students place their masks on a large wall mural depicting the desert food web.

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